Schottky methods for atomic physics experiments at GSI's and FAIR's storage ring facilities

Christian Trageser[1,2], Carsten Brandau[1,2,3], Christophor Kozhuharov[2], Yuri Litvinov[2,4], Alfred Müller[1], Fritz Nolden[2], Shahab Sanjari[2,5], Thomas Stöhlker[2,6,7]

[1]*Justus-Liebig Universität, Gießen, Germany*
[2]*GSI-Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany*
[3]*ExtreMe Matter Institute, EMMI, and GSI research division, Darmstadt, Germany*
[4]*Ruprecht-Karls-Universität, Heidelberg, Germany*
[5]*Goethe-Universität, Frankfurt, Germany*
[6]*Friedrich-Schiller-Universität, Jena, Germany*
[7]*Helmholtz Institut, Jena, Germany*
c.trageser@gsi.de

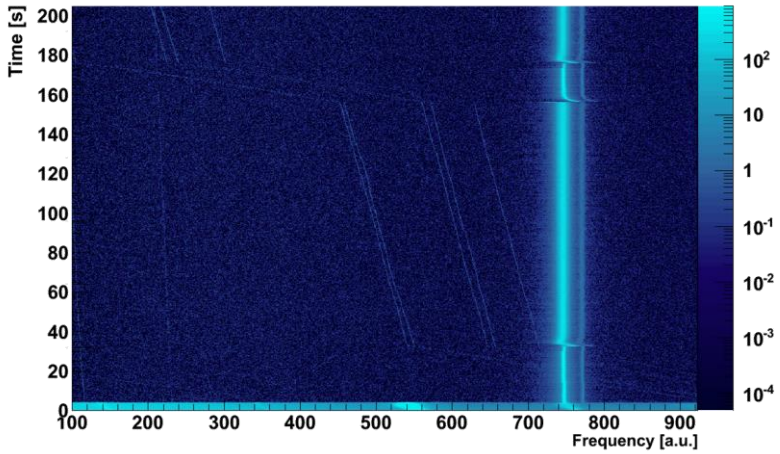

Fig.1 Schottky-spectrum (revolution frequency) during the preparation and conduction of a DR experiment with a beam of $^{234}Pa^{88+}$ ions at the ESR.

In storage rings and synchrotrons Schottky-probes are commonly used non-destructive tools to determine properties of the circulating ion beams [1]. Mainly at the ESR storage ring of GSI the Schottky approach has been developed as a precision physics technique to study atomic masses, nuclear lifetimes and β-decays down to the level of a single stored heavy ion [2]. In addition, Schottky methods are an indispensable diagnostics of dielectronic recombination (DR) experiments with artificially in-flight synthesized radioisotopes [3,4,5,6]

Only recently a new resonant Schottky resonator with an increased sensitivity and time resolution was designed and implemented in the ESR [7]. Presently, a new continuous data acquisition system is installed. In this contribution we will discuss potential applications of these next-generation Schottky systems with emphasis on diagnostics and non-destructive particle detection for atomic physics experiments in storage rings.

Work supported by BMBF (contracts 06GI911I and 06GI7127/05P12R6FAN), by the Helmholtz Alliance HA216/EMMI and by the Helmholtz graduate school HGS-HIRe.

References:
[1] D. Boussard, in: *CERN Accel.School*, Rhodos, 1993, S. Turner (ed.), CERN-95-06, 749 (1995).
[2] Yu. A. Litvinov and F. Bosch, Rep. Prog. Phys. **74** , 016301 (2011).
[4] C. Brandau and C. Kozhuzharov, in: *At. Proc. in Basic and Applied Physics*, V.A. Shevelko and H.Tawara (eds.), Springer Ser. on At., Opt., and Plasma Phys., Vol. **68**, 283-306 (2012).
[5] C. Brandau, C. Kozhuharov, A. Müller et al., J. Phys.: Conf. Ser. **194**, 012023 (2009).
[6] C. Brandau, C. Kozhuharov, A. Müller et al., Hyperf. Int. **196**, 115 (2010).
[7] F.Nolden, P.Hülsmann, Yu.A. Litvinov et al. Nucl. Instrum. Meth. A **659**, 69 (2011).